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IS 11830-2 (1989): Water-well drilling - Down-the-hole hammer rigs, Part 2: General requirements for pneumatic rigs [MED 21: Diamond Core and Waterwell Drilling]



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“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

WATER-WELL DRILLING — DOWN-THE-HOLE HAMMER RIGS

PART 2 GENERAL REQUIREMENTS FOR PNEUMATIC RIGS

भारतीय मानक

**जल कूप वेधन — डाउन-द-होल हैमर रिग
भाग 2 वायुचालित रिगों की सामान्य अपेक्षाएं**

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FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards on 8 February 1989 after the draft finalized by Diamond Core and Water-Well Drilling Sectional Committee, had been approved by the Mechanical Engineering Division Council.

Various types of drilling rigs are employed for water-well drilling. The selection and use of the drilling rigs depends upon the situations in which they have to be used, such as various formations they have to encounter, depth of drilling, etc. This standard is one of a series on various types of drilling rigs. Other standards in this series are:

IS 7156 : 1974 General requirements for reverse circulation drilling rigs;

IS 7206 (Part 1) : 1986 General requirements for direct circulation rotary drilling rigs: Part 1 With rotary table (*first revision*);

IS 7209 : 1974 General requirements for blast hole drilling rigs; and

IS 11830 (Part 1) : 1986 General requirements for down-the-hole hammer rigs for water-wells: Part 1 Hydraulic rigs.

IS 226 : 1975 Structural steel (standard quality) (*fifth revision*) referred to in this Indian Standard may be substituted by Grade A of IS 2062 : 1984 Weldable structural steel (*third revision*) after December 1989.

Indian Standard

WATER-WELL DRILLING — DOWN-THE-HOLE HAMMER RIGS

PART 2 GENERAL REQUIREMENTS FOR PNEUMATIC RIGS

1 SCOPE

This Indian Standard (Part 2) lays down the general requirements for down-the-hole (DTH) hammer pneumatic drill rigs for water-well drilling in consolidated formations.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
IS 266 : 1975	Specification for structural steel (standard quality) (<i>fifth revision</i>)
IS 1161 : 1969	Specification for steel tubes for structural purposes (<i>third revision</i>)
IS 4270 : 1983	Specification for steel tubes used for water-wells (<i>first revision</i>)
IS 9439 : 1980	Glossary of terms used in water-well drilling , technology

3 TERMINOLOGY

For the purpose of this standard, terminology as given in IS 9439 : 1980 shall apply.

4 FUNCTIONS

This type of drilling rigs are used for water-well drilling and exploration purposes in predominantly hard rock formations. The DTH hammer which is always operating at the bottom of the hole and is supplied with compressed air through the drill pipes, carries out drilling operation. The piston of the hammer delivers successive blows at a high frequency to the bit which breaks the formation into smaller fragments. The compressed air after operating the hammer is exhausted through the bit and brings out the cutting to the surface. Lubricating oil for the hammer is injected into the compressed air and lubricates various parts of the DTH hammer. The drill string is rotated at a low speed (rev/min) suitable to the formation so that the buttons of the bit strikes fresh surface after each blow. DTH hammer is also used for drilling in overburden as pneumatically operated rigs do not develop sufficient torque for drilling in overburden with drag/rock roller bits.

5 CONSTRUCTION DETAILS

5.1 In pneumatic DTH rigs rotation and feed mechanism are operated by air motors. Only raising and lowering of the mast (levelling jacks and rod breaking system) may be carried out hydraulically. The hydraulic pump is driven by an air motor. It may also be driven by prime mover of the compressor or by the truck engine through Power-Take-Off (PTO). Thus ultimately all the functions of the rig are powered by compressed air and a single compressor of suitable capacity is provided to meet the requirements of the rig. Construction details of a typical pneumatic DTH drilling rig are described in 5.2 to 5.13. These are only guidelines for manufacturers and users of drilling rigs and do not constitute any specific recommendations.

5.2 Supporting Frame

Constructed of welded structural steel sections, the frame is usually designed to be mounted directly on the chassis or the flat bed of the carrier selected. The mast is mounted on the frame.

5.3 Mast

The mast is constructed either from steel conforming to IS 226 : 1975 or from steel tubes conforming to IS 1161 : 1979. The mast shall be capable of being lowered to horizontal position for transportation and raised to vertical position for drilling operation. The length of the mast depends upon the lengths of the drill pipe used for drilling. The rotation unit travels on the mast. The feed mechanism is by a chain going endlessly over two sprockets at the two ends of the mast. The chain is driven by a pneumatic feed motor through a worn gear. The retract force developed by feed mechanism shall be adequate for pulling out drill string for the rated depth. It is desirable that the design of the feed mechanism shall incorporate a provision for applying negative feed force. When drilling has progressed to a depth at which the weight of the drill string exceeds the desired bit load. At the lower end of the mast, a drill pipe support fitted with different guide slips to suit different dimensions of drill pipes and casing tubes is provided. The mast is raised and lowered hydraulically.

5.4 Top Head Rotary Drive/Rotation Unit

The rotation unit is mounted on the mast and is powered by air motor of adequate power to

provide necessary torque for drilling. The rotation unit shall have a steplessly variable spindle speed from 0 to 50 rev/min. The spindle which is connected to the drill pipe is provided with suitable specified threads.

5.5 Rod Handling System

With 100 mm nominal DTH hammer, drill pipes of 76 mm diameter and 3 m long are most commonly used. The weight of such drill pipes being around 30 kg, these are usually manually handled. However for drilling with 152 mm nominal DTH hammers, drill pipes of 114 mm diameter are used which are quite heavy for manual handling and the rigs shall have arrangement for lifting the drill pipes. A suitable mechanism, preferably with an air winch with suitable rod changer, of adequate capacity shall be provided.

5.6 Hydraulic System

This consists of an air motor driven hydraulic pump and a hydraulic oil tank of suitable capacity for powering the mast raising cylinder, hydraulic jack and break-out wrench. Spool valves are provided for controlling the different hydraulic cylinders.

5.7 Hydraulic Break-Out Wrench

This may be provided for breaking the drill pipe joints. Hydraulic break-out wrench is generally not used for drill pipes up to 76 mm diameter as these can be broken with manual wrenches.

5.8 Hydraulic Jacks

Hydraulic jacks are provided for levelling the machine and lifting the wheels of the carrier off the ground for drilling operations.

5.9 Air Line Lubricator

Air line lubricator of sufficient capacity shall be provided for lubricating the DTH hammer and air motors.

5.10 Water Injection Pump

An air operated water injection pump capable of injecting water under pressure into the compressed air line shall be provided for dust control as well as to help flushing of moist clay or similar formations.

5.11 Lighting System

The drilling operations are carried out throughout day and night. A lighting system powered by the compressor battery shall be provided for adequate illumination.

5.12 Controls

All the controls required for drilling operations shall be grouped together and mounted on either right or left side of the driller's station. The controls for setting up the rig shall be

grouped separately so that they are not accidentally operated while drilling.

5.13 Air Compressor

The compressor of the rig shall be either mounted on the rig or carried on a separate trailer/carrier. The free air delivery of the compressor shall be adequate for meeting the requirements of the DTH tool and for achieving minimum return velocity of 1370 metres per minutes besides meeting the requirements of air motors. The minimum air pressure for DTH drilling is 0.7 MPa. Depending upon the type and operating pressure of DTH hammer used air pressure requirement may vary from 0.7 MPa to 2.45 MPa for light to heavy DTH rig.

6 MOUNTING

All the above components put together comprise one DTH drill rig. The whole equipment shall be mounted on a steel welded structure mounted on a roadworthy truck of adequate capacity or on a trailer chassis with pneumatic wheels suitable for towing by tractor or trucks. The total length, width and height of the rig shall conform to the Statutory Acts, Rules Regulations and other specific orders.

7 DRILL TOOLS AND ACCESSORIES

Following are the essential tools, accessories required for drilling operations.

7.1 Drill Pipes

Drill pipes shall conform to IS 4270 : 1983 and shall be fitted with tool joints. The diameter of the drill pipes depends on the size of the hammer.

7.2 DTH Hammer

The hammers are of two varieties, namely:

- a) Low/medium pressure hammers which operate at air pressures ranging between 0.7 MPa to 1.36 MPa; and
- b) High pressure hammers which operate at air pressures above 1.26 MPa.

7.3 Bits

The DTH hammers use button/cross bits of various sizes for drilling in hard rock and overburden.

7.4 Wrenches

Wrenches for breaking out drill pipe joints and bits shall be provided.

7.5 Grinder

Air operated hand grinder for button bits shall be provided.

8 TESTING

Testing shall be as agreed to between the purchaser and the supplier.

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